

Amendments to the Claims

The following Listing of Claims replaces all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 47 (currently amended): A vertical cavity surface emitting laser (VCSEL), comprising:

a first mirror stack;

a second mirror stack;

a cavity region disposed between the first mirror stack and the second mirror stack, wherein the first mirror stack, the cavity region, and the second mirror stack are arranged along a vertical direction, and the cavity region includes and including an active region, a first side facing the first mirror stack, and a second side facing the second mirror stack;

a defect source located such that only one of the first and second sides of the cavity region faces the defect source; and

a reliability-enhancing layer positioned within the defect source to reduce migration of defects in the vertical direction from the defect source to the active region, whereby the reliability-enhancing layer reduces defect-induced degradation of the active region by the defect source one or more VCSEL regions.

Claim 48 (currently amended): A vertical cavity surface emitting laser (VCSEL), comprising:

a first mirror stack;

a second mirror stack;

a cavity region disposed between the first mirror stack and the second mirror stack and including an active region;

a defect source; ~~and~~

a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of the active region by the defect source one or more VCSEL regions, wherein the defect source is disposed between the reliability-enhancing layer and the cavity region; and

a second reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of the active region by the defect source, wherein the second reliability-enhancing layer is separated from the first reliability-enhancing layer by one or more other layers and the first and second reliability-enhancing layers are located on opposite sides of the defect source.

Claim 49 (canceled)

Claim 50 (original): A vertical cavity surface emitting laser (VCSEL), comprising:
a first mirror stack;
a second mirror stack;
a cavity region disposed between the first mirror stack and the second mirror stack and including an active region;
a defect source; and
a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions, wherein the reliability-enhancing layer is configured to at least in part balance strain created by the defect source.

Claim 51 (original): The VCSEL of claim 50, wherein the defect source includes an oxide region inducing a compressive strain field, and the reliability-enhancing layer is positioned within the compressive strain field and is characterized by tensile strain.

Claim 52 (original): The VCSEL of claim 50, wherein at least one of the first and second mirror stacks comprises oxidized AlGaAs layers and the reliability-enhancing layer is formed from $\text{In}_x\text{Ga}_{1-x}\text{P}$, wherein $x < 0.5$ tensile.

Claim 53 (original): A vertical cavity surface emitting laser (VCSEL), comprising:
a first mirror stack;
a second mirror stack;
a cavity region disposed between the first mirror stack and the second mirror stack and including an active region;
a defect source; and

a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions, wherein the defect source creates a concentration gradient inducing defect migration, and the reliability-enhancing layer introduces strain that reduces ~~is configured to reduce~~ the induced defect migration.

Claim 54 (currently amended): A method of manufacturing a vertical cavity surface emitting laser (VCSEL), comprising:

forming a first mirror stack, a second mirror stack, and a cavity region disposed therebetween, wherein the first mirror stack, the cavity region, and the second mirror stack are arranged along a vertical direction, and the cavity region includes an active region, a first side facing the first mirror stack, and a second side facing the second mirror stack;

forming a defect source located such that only one of the first and second sides of the cavity region faces the defect source; and

forming a reliability-enhancing layer, wherein the reliability-enhancing layer is positioned within the defect source to reduce migration of defects in the vertical direction from the defect source to the active region, whereby the reliability-enhancing layer reduces defect-induced degradation of the active region by the defect source ~~one or more VCSEL regions~~.

Claim 55 (currently amended): A method of manufacturing a vertical cavity surface emitting laser (VCSEL), comprising:

forming a first mirror stack, a second mirror stack, and a cavity region disposed therebetween, wherein the cavity region includes an active region;

forming a defect source; ~~and~~

forming a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of the active region by the defect source ~~one or more VCSEL regions~~, wherein the defect source is disposed between the reliability-enhancing layer and the cavity region; and

forming a second reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of the active region by the defect source, wherein the second reliability-enhancing layer is separated from the first reliability-enhancing

layer by one or more other layers and the first and second reliability-enhancing layers are located on opposite sides of the defect source.

Claim 56 (canceled)

Claim 57 (original): A method of manufacturing a vertical cavity surface emitting laser (VCSEL), comprising:

forming a first mirror stack, a second mirror stack, and a cavity region disposed therebetween, wherein the cavity region includes an active region;

forming a defect source; and

forming a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions, wherein the reliability-enhancing layer is configured to at least in part balance strain created by the defect source.

Claim 58 (original): The method of claim 57, wherein the defect source includes an oxide region inducing a compressive strain field, and the reliability-enhancing layer is positioned within the compressive strain field and is characterized by tensile strain.

Claim 59 (original): The method of claim 57, wherein at least one of the first and second mirror stacks comprises oxidized AlGaAs layers and the reliability-enhancing layer is formed from $\text{In}_x\text{Ga}_{1-x}\text{P}$, wherein $x < 0.5$ tensile.

Claim 60 (original): A method of manufacturing a vertical cavity surface emitting laser (VCSEL), comprising:

forming a first mirror stack, a second mirror stack, and a cavity region disposed therebetween, wherein the cavity region includes an active region;

forming a defect source; and

forming a reliability-enhancing layer positioned with respect to the defect source to reduce defect-induced degradation of one or more VCSEL regions, wherein the defect source creates a concentration gradient inducing defect migration, and the reliability-enhancing layer introduces strain that reduces ~~is configured to reduce~~ the induced defect migration.

Claim 61 (new): The VCSEL of claim 50, wherein the reliability-enhancing layer is adjacent the defect source.

Claim 62 (new): The VCSEL of claim 50, wherein the reliability-enhancing layer is within the defect source.

Claim 63 (new): The method of claim 57, wherein the reliability-enhancing layer is adjacent the defect source.

Claim 64 (new): The method of claim 57, wherein the reliability-enhancing layer is within the defect source.

Claim 65 (new): The VCSEL of claim 53, wherein the defect source creates a Group V element vacancy gradient, and the reliability-enhancing layer has a Group V element vacancy concentration selected to block defect migration from the defect source to the active region.

Claim 66 (new): The method of claim 60, wherein the defect source creates a Group V element vacancy gradient, and the reliability-enhancing layer has a Group V element vacancy concentration selected to block defect migration from the defect source to the active region.